construction engineering research laboratory

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TRACT LEVEL SOCIOECONOMIC DATA SYSTEM
(TRACT) USER MANUAL

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by
R. D. Webster
A. B. Moy

CERL

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The purpose of this study was to develop and document a system for providing sub-county updated estimates for specified socioeconomic statistics to be used in the preparation of environmental impact studies. The data were acquired, a system configuration was designed and implemented, and the system is currently available for DOD usage as a supplement to other Environmental Technical Information System (ETIS) components.

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FOREWORD

This project was performed for the Department of the Air Force Civil Engineering Center under JON 21039P02 and provided to CERL through MIPR Number FY 8952-76-65012, July 1976.

The work was performed by the Environmental Division (EN), U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, IL.

This research was made possible through the efforts of Air Force personnel, and the scientists and engineers of CERL. Administrative support and counsel were provided by Dr. R. K. Jain, Chief of EN.

COL J. E. Hays is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

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3

CONTENTS

4

TRACT LEVEL SOCIOECONOMIC DATA
SYSTEM (TRACT) USER MANUAL

1 INTRODUCTION

Background

Recent litigation[1] has emphasized the importance of socioeconomic impact as a consideration in Department of Defense (DOD)[2] assessments of environmental impacts as required by the National Environmental Policy Act (NEPA).[3]

Data to address socioeconomic impacts are available from the Department of Commerce, the Bureau of Economic Analysis (BEA), the Bureau of Census, and from several commercial[4] and governmental systems.[5] However, the efficacy of data supplied by these agencies is mitigated by several factors.

1. Age: For most socioeconomic variables, data supplied by the Bureau of Census are limited to statistics gathered every 10 years.* Because the relative age of data is important when estimating impacts in a society as mobile as that of the United States, where populations have

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[1] "McDowell vs Schlesinger," U.S. District Court, Western District of Missouri, Western Division, No. 75-CV-234-W-4 (June 19, 1975); "Breckinridge et al., vs Schlesinger," U.S. District Court, Eastern District of Kentucky, No. 75-100 (October 31, 1975).

[2] *Management Reduction and Realignment Actions*, AR 5-10 (Department of the Army, August 1977); *Planning Process: Multiobjective Planning Framework*, ER 1105-2-200 (Department of the Army, November 1975).

[3] National Environmental Policy Act of 1969, 83 Stat 852, 42USC 4321 et seq. (January 1970); R. K. Jain, L. V. Urban, and G. S. Stacey, *Environmental Impact Analysis--A New Dimension in Decision Making* (Van Nostrand Reinhold, 1977).

[4] *ONSITE User's Manual* (Urban Decision Systems, Inc., September 1974); *SITE II* (Consol and Centers [CACI], Inc., 1973).

[5] *Quick Query User's Manual* (Consolidated Analysis Centers, Inc., 1973); Webster, R. D., R. A. Mitchell, R. L. Welsh, Ewa Shannon, and M. L. Anderson, *The Economic Impact Forecast System: Description and User Instructions,* Technical Report N-21/ADA027139 (U.S. Army Construction Engineering Research Laboratory (CERL), June 1976).

* Beginning in 1985, Bureau of Census statistics will be updated every 5 years.

shifted dramatically since 1970, altering housing supply and demand, impact assessments based on 1970 statistics will generally be inadequate.

2. Insufficient detail: Socioeconomic impact assessments should consider, to the maximum practical extent, impacts on sub-county communities. However, most current census data use the county as the base measurement; though these data are sufficient for general level analyses, they provide little aid to the identification of migration or changing patterns within a county.

3. Poor access methodology: Current data acquisition methods available to the DOD user--written data requests, contract or requisition processing, data surcharged per report or per geographic unit, and others--are slow and expensive. The DOD user must usually preclude acquisition of appropriate data from these systems for DOD impact assessments because of the time and fund limits inherent to DOD assessment studies.

These current-source shortcomings are significant; litigation is often occasioned by antiquated data, failure to consider impact on sub-county communities, and lack of adequate assessment documentation. If tools to adequately address these shortcomings are not developed, potential litigation against DOD assessments is assured.

Purpose

The purpose of this study was to develop an easily accessible computer-aided system capable of supplying recent, geographically detailed socioeconomic data for DOD impact assessment studies.

Approach

This research effort included (1) an assessment of user needs, (2) acquisition of necessary data, (3) development of a suitable software package, and (4) system documentation.

6

2 PROCEDURE

User Requirements

The Tract Level Socioeconomic Data System (TRACT) was developed to satisfy DOD user requirements for a more efficient computer-aided system methodology and improved data quality, and to offset, where possible, constraints on the acquisition of appropriate data.

The level of detail of most socioeconomic data available to the DOD user is dependent upon the geographic aggregation system used by the Bureau of Census: blocks, block groups, tracts, places, counties, Standard Metropolitan Statistical Areas (SMSAs), and states (in order of increasing size).[6] Bureau of Census designations also include Standard Consolidated Statistical Areas (SCSAs), urbanized areas, Minor Civil Divisions (MCDs), Census County Divisions (CCDs), and Enumeration Districts (EDs). Details of these categorizations are given in Appendix A.

These standard categories are subject to regional modification, e.g., county units for Virginia are supplemented by independent cities; New York City counties are designated boroughs; Louisiana counties are designated parishes; St. Louis, Missouri is designated an independent city. Independent cities, parishes, and boroughs are treated as counties for the purposes of DOD users.

Data for DOD assessment studies are best calculated from tract-level statistics.* Block statistics, the first unit of census aggregation, would be the ideal level of detail, as data for any other unit could be obtained through summation; however, statistics below tract level are rarely reported even within Bureau of Census publications. Although methods for disaggregating tract-level statistics to block level are available, they are primarily tools for reaggregating statistics by means of centroidal location for area-boundary definitions, as in marketing analyses studies for multi-tract shopping or marketing regions. The effort necessary to obtain block statistics seems beyond the scope of most assessment requirements. Any need for this level of detail could be met through the use of commercially available services.[7]

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[6] *Environmental Socioeconomic Data Sources -- Tab A-1 Supplement* (Department of the Air Force and US Department of Commerce, October 1969); some systems under development, such as the TAB A-1 Environmental Narrative, are community specific and do not depend upon this classification.

* Nontracted areas are included in MCD statistics.

[7] *ONSITE User's Manual* (Urban Decision Systems, Inc., September 1974).

Acquisition of Appropriate Data

Because recent income and population data for sub-counties are essential to the preparation of accurate socioeconomic impact assessments, CERL sought data sources updated from 1970 Bureau of Census and 1974 BEA statistics. Based upon past experience[8] and Air Force preference, data supplied by the National Planning Data Corporation (NPDC) were chosen. CERL obtained NPDC's entire U.S. file of approximately 35,000 tracts and MCD's. This file contains the following data:

Geographic Identification

1960 Population

1970 Population

1976 Population Update

1969 Per Capita Income

1975 Per Capita Income Update

1969 Average Household Income

1975 Average Household Income Update

1970 Number of Households

1976 Number of Households Update

Other data elements, such as employment statistics, will be incorporated into TRACT as they are identified and as the DOD user's requirements expand.

System Design and Configuration

Following data acquisition, software was designed and configured to select and report statistics by tract or MCD. The source code for this system, TRACT, is included in Appendix B. Specific user instructions and sample output are presented in Chapter 3 and some discussion of updated statistics is presented in Chapter 4. TRACT is configured to interface with subsystems of the Environmental Technical Information

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[8] *Final Environmental Impact Statement (EIS) Formulation of the U.S. Army Electronics Research and Development Command* (Department of the Army, August 1976).

System (ETIS),[9] specifically the Economic Impact Forecast System (EIFS). TRACT demands less time, expense, and technical skill of the DOD user than do other available computer-aided data retrieval systems. At present, user instructions document the system as an independent element, but future plans call for the accession of TRACT as an additional profile under EIFS. This feature will be addressed in detail in the subsequent, newer version of the EIFS user manual.

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[9] Webster, R. D., et al., *Development of the Environmental Technical Information System*, Interim Report E-52/ADA009668 (CERL, April 1975); Welsh, R. L., *User Manual for the Computer-Aided Environmental Legislative Data System*, Technical Report E-78/ADA01918 (CERL, November 1975); Webster, R. D., et al., *The Economic Impact Forecast System: Description and User Instructions*, Technical Report N-2/ADA027139 (CERL, June 1976).

9

3 USER INSTRUCTIONS

Obtaining Output

To use TRACT, dial the Center for Advanced Computation's (CAC's) minicomputer at 217/333-1587. After the call is acknowledged (indicated by a high pitched tone), place the phone in the acoustic coupler of the portable terminal. Set the terminal at "30 cps" or "high-speed," "full duplex," and "on line." The computer will respond as follows (user responses are underlined; "carriage return" must be pressed following each command):

```
CSO NETWORK UNIX SYSTEM
LOGIN: Webster          Login supplied to user by CERL

PASSWORD: Ron           Password assigned by CERL
                        or CAC (may be changed at
                        discretion of user). Note: the
                        password will not appear on
                        the terminal when it is
                        typed.

% ETIS                  The "%" sign signifies that the
                        computer is ready for a command.
                        The "ETIS" command
                        identifies the desired system
                        to the computer. TRACT, originally
                        a separate program, has been
                        incorporated into ETIS.
```

WELCOME TO CERL's ENVIRONMENTAL TECHNICAL INFORMATION SYSTEM

WHAT PROGRAM? (TYPE <CR> TO SEE LIST) _ (carriage return)

Once the system is identified by the computer as above, the user should press the carriage return (<CR>) button. The system will respond:

```
TYPE 1       FOR INTRODUCTION TO ETIS
TYPE 3       TO RUN CELDS
TYPE 4       TO RUN EIFS
TYPE !MAIL   TO SEE YOUR MAIL
TYPE CTRL-D  TO EXIT

WHAT PROGRAM? ( TYPE <CR> TO SEE LIST ) 4
```

TRACT is available as part of EIFS; therefore, the user should type "4". The system will then request regional definition:

10

```
FIRST COUNTY OR REGION: CHAMPAIGN, IL
NEXT COUNTY ( OR <CR> IF DONE ): _ (carriage return)
```

The user may select either a single county or a multicounty for aggregation. (In the following example, a single county is selected for aggregation).

```
YOU HAVE SELECTED:
     COUNTY                    STATE   POPULATION   AREA   (SQ MI)
CHAMPAIGN                        IL     163,281    1,000

TOTAL                                   163,281    1,000

WHAT PROFILE ? ( <CR> TO SEE LIST ) ; (carriage return)
TYPE     1      FOR OVERVIEW PROFILE
TYPE     2      FOR OVERVIEW BY COUNTY
TYPE     3      FOR TIME SERIES PROFILE
TYPE     4      FOR THE FORECAST MODEL
TYPE     5      FOR VALADO PROFILE
TYPE     6      FOR RTV
TYPE     7      FOR DETAILED EMPLOYMENT PROFILE
TYPE     8      TO INPUT YOUR OWN MULTIPLIER
TYPE     9      FOR EXPORT EMPLOYMENT PROFILE
TYPE    10      FOR CENSUS DATA BY TRACT OR MCD
TYPE     _      TO SELECT A DIFFERENT REGION
TYPE  CNTRL-D   TO LEAVE THE PROGRAM
```

Profile 10 contains the required information. To obtain it, the user should type "10":

```
WHAT PROFILE ? ( <CR> TO SEE LIST ) ; 10

CHAMPAIGN, IL; 33 MCDs AND/OR TRACTS

DO YOU WANT TO SEE THEM?  YES
```

At this point, data required by the user will be printed on the portable terminal, as in Table 1.

To assure the DOD user data availability for the entire United States, TRACT retains both tract and MCD statistics. Tract level data are identified as "T" in column 1. MCD data are identified as "M".

Counties which list extensive tract data can also create user problems. For example, Cook County, IL, is the tracted part of the Chicago SMSA, and data available for it are extensive. TRACT will indicate such lengthy listings to the user and give the user the opportunity of retrieving it immediately, or at a later date by repeating the command sequence as outlined above.

11

Table 1

Sample TRACT Output

UNIT CODE	POPULATION 1960	1970	1976	'70/60	HH 1970	1976	HH INCOME 1969	1975	PER CAP INC 1969	1975
T 1	464	670	867	0	441	597	6,011	12,477	5,276	8,300
T 2	2,225	2,740	2,084	23	859	726	6,238	10,803	1,955	3,643
T 3	3,277	4,010	3,254	648	1,800	1,702	3,710	8,466	4,065	6,181
T 4	5,557	6,818	6,239	5,236	792	796	2,675	9,302	3,656	8,474
T 5	3,633	4,448	4,165	36	1,764	1,725	11,420	19,371	4,529	7,760
T 6	3,369	4,123	3,534	46	1,950	1,744	10,217	14,071	4,832	6,718
T 7	3,885	4,784	4,823	50	1,677	1,767	7,450	8,904	2,611	3,155
T 8	1,430	1,761	2,101	0	488	643	9,392	10,624	2,603	3,144
T 9	4,701	5,788	5,491	6	1,731	1,714	9,000	15,348	2,692	4,635
T 10	4,360	5,368	4,693	49	1,922	1,753	9,607	16,110	3,440	5,822
T 11	4,232	5,211	4,788		1,715	1,644	13,300	22,163	4,377	7,371
T 12	7,518	9,256	10,458	112	2,405	2,499	11,527	18,448	3,004	5,128
T 13	4,472	5,506	5,803		1,629	1,905	13,957	21,961	4,129	6,975
T 14	3,165	3,897	5,310	3,311	193	273	1,983	6,055	2,935	5,977
T 51	121	166	492	25	103	334	5,079	19,262	6,684	12,342
T 52	1,738	2,377	2,671	61	1,102	1,435	5,762	11,770	4,749	6,467
T 53	2,906	3,974	3,754	273	1,257	1,236	8,146	9,747	2,626	3,172
T 54	3,274	4,478	5,292	77	1,505	1,999	9,234	10,260	3,103	3,749
T 55	4,910	6,715	6,354	235	2,284	2,257	9,654	9,365	2,690	3,250
T 56	3,106	4,248	4,382	6	1,322	1,518	7,836	15,227	3,004	5,103
T 57	3,326	4,549	5,640	0	1,421	1,962	14,251	22,081	4,452	7,429
T 58	3,178	4,346	2,990	263	1,720	1,324	13,199	19,678	5,267	8,506
T 59	4,666	6,382	5,348	4,704	794	600	3,074	5,571	3,394	4,101
T 60	3,559	4,868	3,752	2,291	827	640	3,909	7,084	2,437	2,945
T 101	7,086	6,798	7,098	0	2,082	2,417	7,303	10,507	2,236	3,461
T 102	7,246	6,946	6,878	3	2,209	2,283	7,348	8,791	2,337	2,823
T 103	6,426	6,191	7,193	1,717	969	1,352	6,460	19,327	2,596	5,178
T 104	6,393	10,786	10,175	3,456	2,256	2,326	6,060	10,982	3,235	3,909
T 105	3,307	3,682	3,357	6	1,126	1,142	7,418	13,638	2,269	4,487
T 106	4,716	6,535	8,246	0	2,062	2,900	9,169	10,276	2,893	3,495
T 107	3,617	4,413	4,759	10	1,408	1,694	8,941	10,011	2,853	3,446
T 108	4,596	4,569	3,691	0	1,499	1,320	8,921	16,784	2,927	5,952
T 109	5,977	6,878	7,330	7	2,049	2,424	9,172	10,319	2,733	3,301
TOTALS	'60 POP 132,436	'70 POP 163,281	'76 POP 162,922		'79 60 22,658	'76 POP 162,922	'70 MH 47,361	'75 MH 51,151	'76 HH 51,151	

B : basic tract code
S : suffix tract code
HH INCOME : average household income
PER CAP INC : per capita income

12

Interpreting and Analyzing Output

The first two printout columns of TRACT identify either the tract or MCD designation for the adjacent row. These designations are Census Bureau standards and are useful only if a tract map or nontracted area map is obtained from the Bureau of Census, local libraries, or private firms in the region under study.

The next three columns are 1960, 1970, and 1976 updated population estimates. The sixth column is the 1970 group quarter count. All persons not living in households are classified as living in group quarters,[10] i.e., *five or more persons unrelated to the household head* or, when no household head is designated, six or more unrelated persons sharing a unit such as a rooming or boarding house, commune, worker or student dormitory, convent or monastery, military barrack, sorority or fraternity house, and some hospital wards, institutional quarters, shelters, etc.

Columns 7 and 8 are the estimated number of households in 1970 and 1976, respectively. Average household income for 1969 and 1975 estimates, along with the per capita income figures for 1969 and 1975 are in columns 9, 10, 11, and 12, respectively.*

TRACT output is best analyzed and presented by preparing a shaded map, such as the one shown in Figure 1. Trends in population and income fluctuations and areas of rapid growth and decline can be displayed clearly and quickly on a spatial scale by shading areas of the map to correspond to the type and/or density of TRACT output indicated for that region. The resultant sub-county unit of analysis is of considerable value to the DOD user, especially if DOD employees reside in areas TRACT output analysis indicates will be the site of a controversial impact. TRACT output supplements demographical data available from EIFS.

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[10] *City County Data Book* (Department of Commerce, 1972), pp xxxiii.

* 1976 household and per capita income rates will be incorporated into TRACT upon their release.
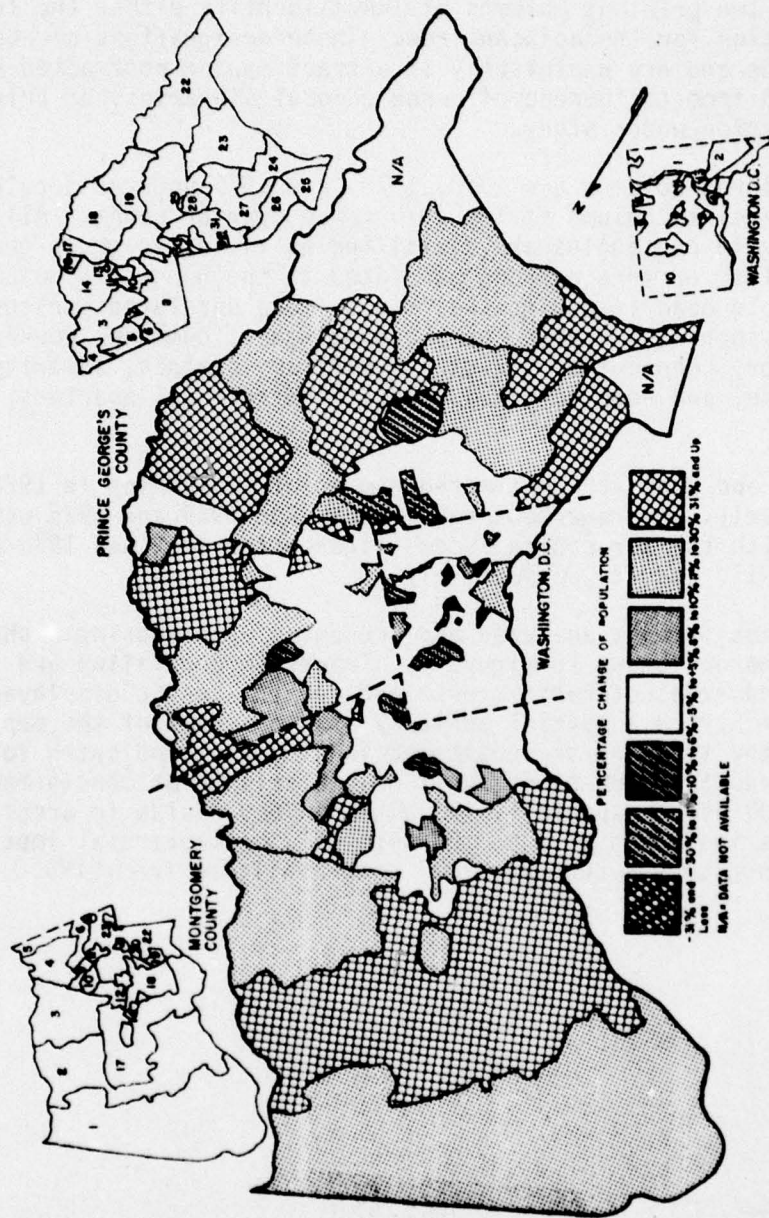
Figure 1. Percentage change of population, 1970 to 1974, District of Columbia, Prince Georges and Montgomery Counties, MD. (From *Final EIS, Formulation of the US Army Electronics Research and Development Command* [Department of the Army, August 1976]).

14

4 UPDATE METHODOLOGY

Although the actual equations and algorithms used in TRACT update
statistics are proprietary to National Planning Data Corporation (NPDC)
and cannot be listed in this report, variables and techniques used by
NPDC can be identified to provide the user with an appreciation of the
value and reliability of updated estimates.[11]

Population and Household Estimates

Population and household estimates of NPDC are not based on tradi-
tional variables such as deaths, school enrollment, building permits,
and utility connections. Rather, four categories of information, avail-
able nationally, are used: 1960 through 1970 population change, housing
characteristics, population density, and revenue sharing.

Tract and MCD boundary changes and 1960 population figures are
adjusted to calculate an estimate of population change between 1960 and
1970.

Population density figures are calculated by delineating the total
land, water, park, industrial development, governmental or institutional
facility area for each tract or MCD. Tracts and MCDs are then strati-
fied on the basis of density, yielding significantly improved population
estimates.

1970 Bureau of Census of population and housing data were obtained
from the second count (100 percent sample) and fourth count (20, 15, and
5 percent sample) statistics. Approximately 40 indicators of population
change were developed. Examples of these variables are housing type,
housing value, age and condition, income, family structure, and employ-
ment.

When revenue-sharing monies are distributed to local governments,
the Bureau of Census prepares population estimates for each local gov-
ernment biennially. These estimates are converted by NPDC to tract and
MCD values.

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[11] *Update, Latest Data on Population, Households, Income* (National Plan-
ning Data Corporation [NPDC]).

Special census areas are selected by NPDC as test areas and a BMD 02R[12] regression analysis run on the data. Post-census indicators, obtained from the Reuben H. Donnelly Corporation, include the annual count of households with a listed telephone number or a registered automobile or both.

Income Estimates

Per capita income statistics are also available from revenue-sharing data by aggregating data gathered from Social Security and Internal Revenue Service (IRS) administrative records. The 1969 and 1972 Census Bureau per capita income figures are the variables used to calculate per capita income estimates. Data on important characteristics which affect income levels, such as occupation, education, race, type of dwelling unit, and recent growth patterns, are stratified by geographic region. BMD 02R regression analysis then relates demographic and locational characteristics to income changes from 1969 to 1972. These relations are adjusted to calculate 1973, 1974, and subsequent estimates with tract or MCD levels cross-checked to total annual county figures by multiplying per capita figures by total population, aggregating data to county level, and comparing to appropriate county-level figures.

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[12] *Biomedical Computer Programs*, Health Sciences Computing Facility, Department of Biomathematics, School of Medicine, University of California (University of California Press, January 1973).

16

5 CONCLUSIONS AND RECOMMENDATIONS

TRACT is an easily accessible, computer-aided supplement to EIFS which was developed to supply recent and detailed socioeconomic data at the sub-county, tract, or MCD level. TRACT will supplement other pro-files available under EIFS and should be used for detailed analysis when preparation of Environmental Impact Assessments or Statements is required.

The MCD and tract files are prototypes. They should be combined into one system or merged with the EIFS program to provide easier access.

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Biomedical Computer Programs, Health Sciences Computing Facility, Department of Biomathematics, School of Medicine, University of California (University of California Press, January 1973).

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Management Reduction and Realignment Actions, AR 5-10 (Department of the Army, August 1977).

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National Environmental Policy Act of 1969, 83 Stat 852, 42USC 4321 et seq. (January 1970).

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Update, Latest Data on Population, Households, Income (National Planning Data Corporation (NPDC)).

Webster, R. D., et al., *Development of the Environmetnal Technical Information System*, Interim Report E-52/ADA009668 (CERL, April 1975).

Webster, R. D., R. A. Mitchell, R. L. Welsh, Ewa Shannon, M. L. Anderson, *The Economic Impact Forecast System: Description and User Instructions*, Technical Report N-2/ADA027139 (CERL, June 1976).

Welsh, R. L., *User Manual for the Computer-Aided Environmental Legislative Data System*, Technical Report E-78/ADA019018 (CERL, November 1975).

APPENDIX A:

DEFINITION OF GEOGRAPHIC AREAS[*]

LIBERTY STREET

HARRIS STREET
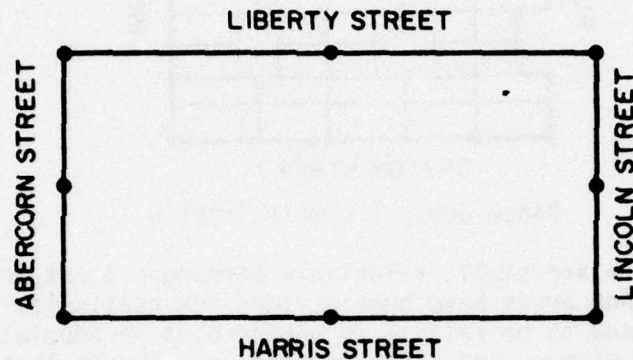
    Blocks, for Census Bureau purposes, are usually well-defined pieces
of land, bounded by streets and roads. Occasionally they are irregular
in shape or partially bounded by railroad tracks, streams, or other features.
Blocks are identified in all urbanized areas and in some selected areas.
Block-level statistics were tabulated in 1970 for urbanized areas within
metropolitan areas.

LIBERTY STREET

JONES STREET
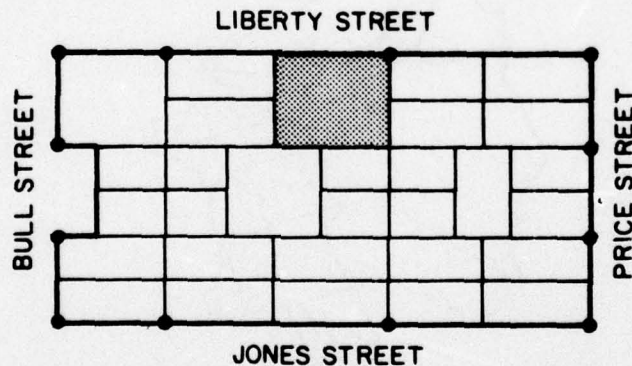
    Block Groups are combinations of blocks and generally have a pop-
ulation of about 1,000. They are subdivisions of census tracts.

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* From *Environmental/Socioeconomic Data Sources - Tab A-1 Supplement*
(US Air Force and US Department of Commerce).

LIBERTY STREET
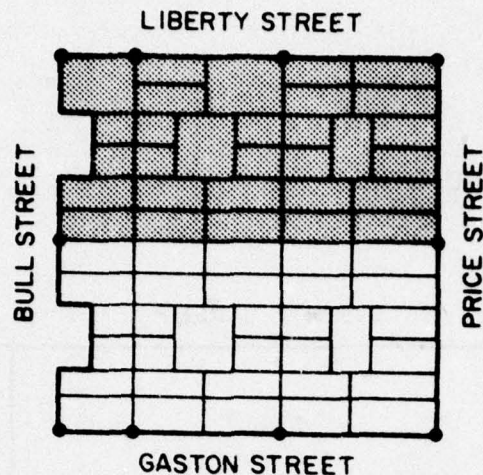
Block Group 1 within Tract 9

Census Tracts are small, relatively permanent areas into which large cities and adjacent areas have been divided for statistical purposes. Tracts are designed to be relatively homogeneous in population character- istics, economic status, and living conditions, though these conditions may change over time. The average tract has about 4,000 inhabitants. Census tracts are used extensively by local agencies in tabulating their own statistics. SMSAs created since 1970 may or may not be completely tracted. Population and housing data from the 1970 decennial census have been published in a series of separate reports by census tract.
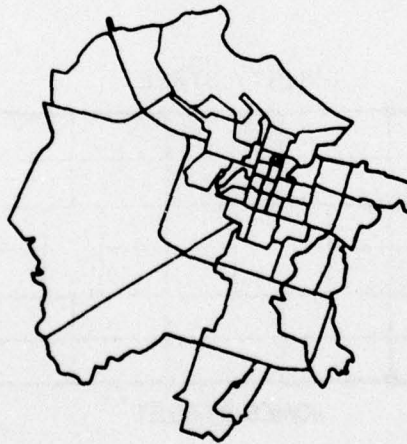

Tract 9 within Savannah

Place, as used by the Census Bureau, refers to a concentration of population. Both incorporated and unincorporated places are covered by census reports. Incorporated places are political units incorporated as cities, towns, villages, and boroughs. (Exceptions include boroughs in Alaska, towns in New England, and townships in New Jersey and Pennsylvania which are considered MCDs.) Unincorporated places are densely settled population centers without legally defined corporate limits. Each has a definite residential nucleus and boundaries are drawn by the Bureau of the Census to include, as much as possible, all the densely settled area.

20

Savannah within Chatham County

Counties are primary political and administrative divisions of states. Data from the 1970 census and the economic censuses are available at this level, as well as limited information from various surveys.

In Louisiana, county equivalents are called parishes; 29 census divisions have been created; in Puerto Rico counties are referred to as "municipos". The District of Columbia, the independent cities of Columbus, Georgia; Baltimore, Maryland; St. Louis, Missouri; Carson City, Nevada; and about 40 cities in Virginia are all treated as county equivalents.

21
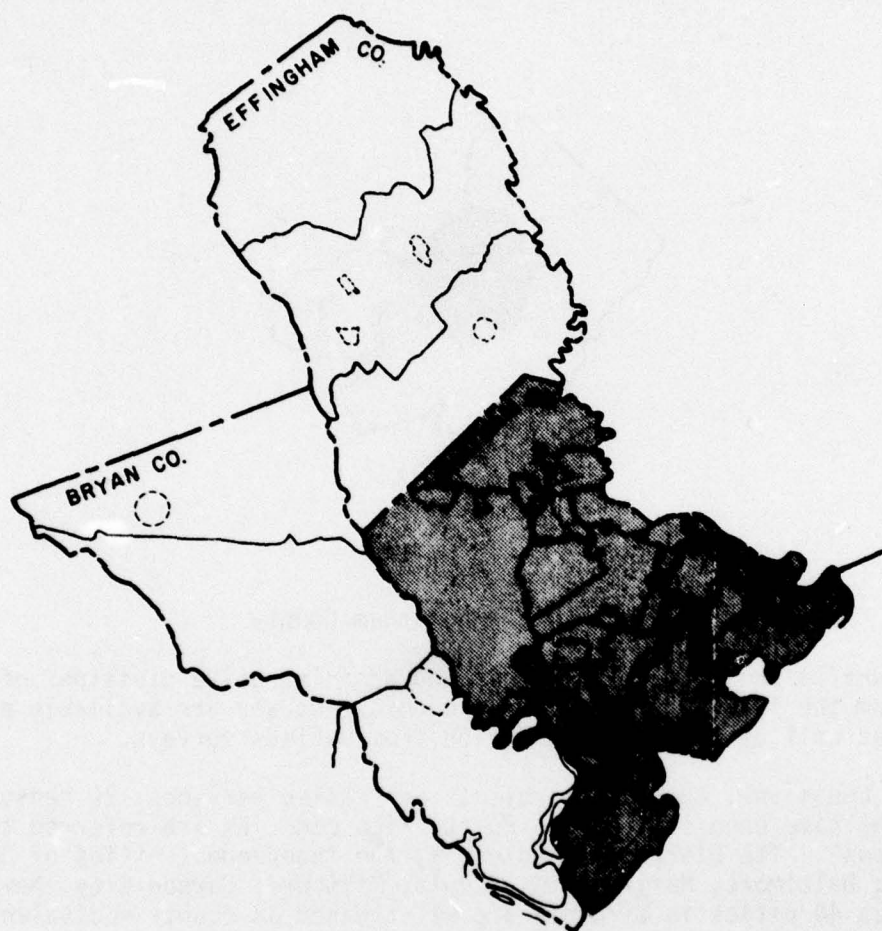
Standard Metropolitan Statistical Areas generally consist of a county
containing at least one city (or twin cities) of 50,000 inhabitants or more,
plus as many adjacent counties which are metropolitan in character and
socially integrated with the central city. The Federal Office of Management
and Budget identifies the central city or cities of each SMSA and uses
their names to identify the SMSA boundaries. Some SMSA's may cross state
lines as, for example, the Washington, D.C.-Maryland-Virginia SMSA.
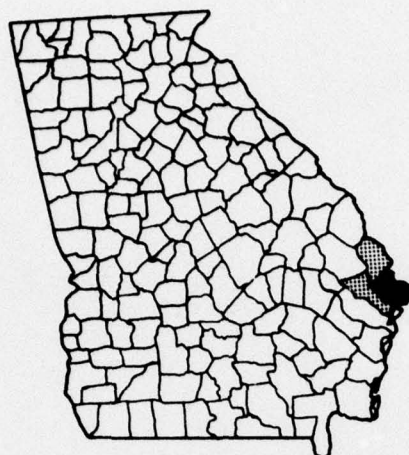
Savannah SMSA within Georgia

States -- Statistics for each state are made available from every census and from most surveys. Separate statistics are also published for the District of Columbia. Data for the outlying areas (Puerto Rico, Guam, and the Virgin Islands) are usually published from every census.

Georgia within the U.S.

The Nation - National totals include data from all 50 states and the District of Columbia. They do not include Puerto Rico or the outlying areas of the Canal Zone, Guam, Samoa, the Virgin Islands, or others unless specified in the publication.

APPENDIX B:

SOURCE DOCUMENTATION FOR TRACT

```
Mar  7 13:20 1977  tracts/tracts.c Page    1


#
#include  "/cerl/tracts/trac_str.i"
float flt  65536.0;
char com[7];
#define  PR  printf

main()
{
struct scsz crec;
struct tracrec trec;
int c, t, sk, i, j, k, oz, rz, ot, rt;
int rem, quo, s, s1, s2, ctp, sklen, cl;
char st[100], cty[100], again[100];

#define  I2   for (i = 0;i < 2;i++)
#define  PC   printf ("%s ", &com)

sklen = 30 * 1092;

do
{ oz = open ("/cerl/tracts/finally", 0);
     if (oz < 0) (perror("file opening"); return;)

  PR ("county : ");
  gets (&cty);
  if (cty[0] == 0)
  { PR ("You have not selected any county. Program terminates\n");
    return;
  }

  PR ("state : ");
  gets (&st);
  if (st[0] == 0)
  { PR ("No state was selected. program terminates\n");
    return;
  }
  else
  { for (i = 0;st[i] == ' ';i++);
    s1 = 0;
    s2 = 0;      /* s1 and s2 are matching indicators */
    for (s = 0;s < 49;s++)
    { rz = read (oz, &crec.flag, 28);
      for (j = 0;st[i+j] == crec.abst[j] && j < 2;j++);
      if (j == 2 && st[i+2] == 0)  /* abbrev. state name match */
         s1 = 100 ;
      else
      { for (j = 0;st[i+j] == crec.state[j] && crec.state[j] != 0;j++);
        if (crec.state[j] == 0)  s2 = 100;   /* match for long string */
      }
      if (s1 == 100 || s2 == 100)    break;
      else
        /* skip county records for this state */
        sk = seek (oz, 28*crec.cnum, 1);
    }
    if (s1 == 100 || s2 == 100)
    { /* now check for county match in this state */
```

26

```
        ctp = 0;    /* county match indicator */
        for (k = 0;cty[k] == ' ';k++);
        for (c = 0;c < crec.cnum;c++)
        { rz = read (oz, &crec.cnty[0], 28);
          for (j = 0;cty[k+j] == crec.cnty[j] && crec.cnty[j] != 0;j++);
          if (crec.cnty[j] == 0)        /* county match */
          { ctp = 100;
            break;
          }
        }
      }
      else
      { PR ("State %s not in states list\n", &st[0]);
        PR ("Would you like to try again? ");
        gets (&again);
        if (again[0] == 'y')
        { cl = close (oz);
          continue;
        }
        else break;
      }

    }

    if (ctp != 100)
    { PR ("County %s not on the list of state %s\n", &cty[0], &st[0]);
      PR ("would you like to try again? ");
      gets (&again);
      if (again[0] == 'y')
      { cl = close (oz);
        continue;
      }
      else  break;
    }
    else
    { if (crec.tsum > 1092.0)
      { quo = crec.tsum / 1092.0 ;
        rem = crec.tsum - (quo * 1092.0) ;
      }
      else
      { rem = crec.tsum;
        quo = 0;
      }
      ot = open ("/cerl/tracts/data", 0);
        if (ot < 0) {perror("file opening_ot"); return;}
      for (i = 0;i < quo;i++)
        sk = seek (ot, sklen, 1);
      sk = seek (ot, 30*rem, 1);
      if (crec.tnum > 40)
      { PR("There are %d tracts in county %s\n", crec.tnum, &cty[0]);
        PR("Would you still like to have them printed? ");
        gets(&again);
        if (again[0] != 'y')
        { PR("Would you like to try another county? " );
          gets (&again);
          if (again[0] == 'y')  continue;
```

27

```
        else break;
      }
    }

    for (t = 0;t < crec.tnum;t++)
    { rt = read (ot, &trec.stc, 30);
      if (t == 0)
         PR ("%s%s\n%s%s\n\n", hdng[0], hdng[1], hdng[2], hdng[3]);
      PR(" %4d ", trec.tr[0]);
      if (trec.tr[1] == 0) PR("    ");
      else PR("%2d ", trec.tr[1]);
      for (i = 0;i < 3;i++)
      { if (trec.pop[i] < 0) pr1(trec.pop[i]);
        else pr2(trec.pop[i]);
        PC;
      }
      if (trec.gq < 0) pr1(trec.gq);
      else pr2(trec.gq);
      PC;
      I2
      { pr2(trec.hh[i]);
        PC;
      }
      I2
      { if (trec.hhi[i] < 0) pr1(trec.hhi[i]);
        else pr2(trec.hhi[i]);
        PC;
      }
      I2
      { pr2(trec.pci[i]);
        PC;
      }
      PR("\n");
    }
    PR("\n");
    PR("B : basic tract code\n");
    PR("S : suffix tract code\n");
    PR("HH INCOME : average household head income\n");
    PR("PER CAP INC : per capita income\n\n");
  }
} while (st[0] != 0 || cty[0] != 0);

}
commas(p)
    char *p;
{ if (*(p+2) != ' ')
  { *p = *(p+1);
    *(p+1) = *(p+2);
    *(p+2) = ',';
  }
}
pr1(aa)
    int aa;
{ float ff;
  ff = flt + aa;
```

```
Mar  7 13:20 1977  tracts/tracts.c Page     4


   PR (-1, &com, "%6.0f", ff);
   commas (&com);
}
pr2(bb)
   int bb;
{ PR (-1, &com, "%6d", bb);
   commas (&com);
}



Mar  7 13:19 1977  tracts/trac_str.i Page      1


struct scsz  {  char cnty[18];     /* county name */
                int  tnum,         /* tracts per county */
                      ss,          /* state code */
                      cc;          /* county code */
                float tsum;        /* no. of tracts from top of data base */


                /* portion below for state record--top for county record */

                char    flag,      /* flag character for state record */
                        abst[2],   /* abbreviated state name */
                        state[21]; /* state name */
                int     sc,        /* state code */
                        cnum;      /* counties per state */

             } ;


/* this structure will contain negative integers. remember to convert */
struct   tracrec

      (  int stc,       /* 70 state code */
            cnc,        /* 70 county code */
          tr[2],        /* basic and suffix */
          smsa,
        pci[2],         /* 69, 75 per cap. income */
        hhi[2],         /* 69, 75 ave. HH income */
        pop[3],         /* 60, 70, 76 pop */
         hh[2],         /* 70, 76 HH */
            gq;         /* pop70 group quarters */
      );

char *hdng[] (
"   TRACTS *********POPULATION********* ------HH----- **",
"HH INCOME** -PER CAP INC-",
"   B  S 1960   1970   1976  '70GQ 1970   1976   ",
"1969   1975   1969   1975" );
```

29

```
May 20 09:28 1977  mcd/mcd_str.i Page      1


struct scsz  {  char cnty[18];      /* county name */
                int   tnum,         /* mcds per county */
                      ss,           /* state code */
                      cc;           /* county code */
                float tsum;         /* no. of mcds from top of data base */


                /* portion below for state record--top for county record */

                char      flag,     /* flag character for state record */
                          abst[2],  /* abbreviated state name */
                          state[21]; /* state name */
                int       sc,       /* state code */
                          cnum;     /* counties per state */

             } ;


/* this structure will contain negative integers. remember to convert */
struct  mcdrec

     {  int stc,     /* 70 state code */
            cnc,     /* 70 county code */
            mcd,
            pci[2],  /* 69, 75 per cap. income */
            hhi[2],  /* 69, 75 ave. HH income */
            pop[3],  /* 60, 70, 76 pop */
            hh[2],   /* 70, 76 HH */
            gq;      /* pop/0 group quarters */
     };

char *hdng[] {
" MCD ********POPULATION******** ------HH----- **",
"HH INCOME** -PER CAP INC-",
"         1960    1970    1976 *7060    1970    1976  ",
"1969    1975    1969    1975" };
```

30

```
May 20 09:13 1977  mcd/mcd.c Page     1


#
#include  "/cerl/mcd/mcd_str.i"
float flt  65536.0;
char com[7];
#define  PR  print1

main()
{
struct scsz crec;
struct mcdrec trec;
int c, t, sk, i, j, k, oz, rz, ot, rt;
int rem, quo, s, s1, s2, ctp, sklen, cl;
char st[100], cty[100], again[100];

#define  I2  for (i = 0;i < 2;i++)
#define  PC  print1 ("%s ", &com)

sklen = 26 * 1260;

do
{ oz = open ("/cerl/mcd/st_cnty", 0);
     if (oz < 0) {perror("file opening"); return;}

  PR ("county : ");
  gets (&cty);
  if (cty[0] == 0)
  { PR ("You have not selected any county. Program terminates\n");
    return;
  }

  PR ("state : ");
  gets (&st);
  if (st[0] == 0)
  { PR ("No state was selected. program terminates\n");
    return;
  }
  else
  { for (i = 0;st[i] == ' ';i++);
    s1 = 0;
    s2 = 0;      /* s1 and s2 are matching indicators */
    for (s = 0;s < 50;s++)
    { rz = read (oz, &crec.flag, 28);
      for (j = 0;st[i+j] == crec.abst[j] && j < 2;j++);
      if (j == 2 && st[i+2] == 0)  /* abbrev. state name match */
         s1 = 100 ;
      else
      { for (j = 0;st[i+j] == crec.state[j] && crec.state[j] != 0;j++);
        if (crec.state[j] == 0)  s2 = 100;   /* match for long string */
      }
      if (s1 == 100 || s2 == 100)   break;
      else
        /* skip county records for this state */
        sk = seek (oz, 28*crec.cnum, 1);
    }
    if (s1 == 100 || s2 == 100)
    { /* now check for county match in this state */
```

31

```
        ctp = 0;    /* county match indicator */
        for (k = 0;cty[k] == ' ';k++);
        for (c = 0;c < crec.cnum;c++)
        { rz = read (oz, &crec.cnty[0], 28);
          for (j = 0;cty[k+j] == crec.cnty[j] && crec.cnty[j] != 0;j++);
          if (crec.cnty[j] == 0)        /* county match */
          { ctp = 100;
            break;
          }
        }
      }
      else
      { PR ("State %s not in states list\n", &st[0]);
        PR ("Would you like to try again? ");
        gets (&again);
        if (again[0] == 'y')
        { cl = close (oz);
          continue;
        }
        else break;
      }

    }

    if (ctp != 100)
    { PR ("County %s not on the list of state %s\n", &cty[0], &st[0]);
      PR ("would you like to try again? ");
      gets (&again);
      if (again[0] == 'y')
      { cl = close (oz);
        continue;
      }
      else   break;
    }
    else
    { if (crec.tsum > 1260.0)
      { quo = crec.tsum / 1260.0 ;
        rem = crec.tsum - (quo * 1260.0) ;
      }
      else
      { rem = crec.tsum;
        quo = 0;
      }
      ot = open ("/cerl/mcd/mcd_data", 0);
        if (ot < 0) {perror("file opening_ot"); return;}
      for (i = 0;i < quo;i++)
        sk = seek (ot, sklen, 1);
      sk = seek (ot, 26*rem, 1);
      if (crec.tnum > 40)
      { PR("There are %d mcds in county %s\n", crec.tnum, &cty[0]);
        PR("Would you still like to have them printed? ");
        gets(&again);
        if (again[0] != 'y')
        { PR("Would you like to try another county? " );
          gets (&again);
          if (again[0] == 'y')  continue;
```

32

```
May 20 09:13 1977  mcd/mcd.c Page      3
          else break;
        }
      }
      for (t = 0;t < crec.tnum;t++)
      { rt = read (ot, &trec.stc, 26);
        if (t == 0)
           PR ("%s%s\n%s%s\n\n", hdng[0], hdng[1], hdng[2], hdng[3]);
        PR(" %3d ", trec.mcd);
        for (i = 0;i < 3;i++)
        { if (trec.pop[i] < 0) pr1(trec.pop[i]);
          else pr2(trec.pop[i]);
          PC;
        }
        if (trec.qq < 0) pr1(trec.gq);
        else pr2(trec.gq);
        PC;
        I2
        { pr2(trec.hh[i]);
          PC;
        }
        I2
        { if (trec.hhi[i] < 0) pr1(trec.hhi[i]);
          else pr2(trec.hhi[i]);
          PC;
        }
        I2
        { pr2(trec.pci[i]);
          PC;
        }
        PR("\n");
      }
      PR("\n");
      PR("HH INCOME : average household head income\n");
      PR("PER CAP INC : per capita income\n\n");
    }
} while (st[0] != 0 || cty[0] != 0);

}
commas(p)
   char *p;
{ if (*(p+2) != ' ')
  { *p = *(p+1);
    *(p+1) = *(p+2);
    *(p+2) = ',';
  }
}
pr1(aa)
   int aa;
{ float ff;
  ff = flt + aa;
  PR (-1, &com, "%6.0f", ff);
  commas (&com);
}
pr2(bb)
May 20 09:13 1977  mcd/mcd.c Page      4
   int bb;
{ PR (-1, &com, "%6d", bb);
  commas (&com);
}
```

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